

## CLAIMS

1. A method for producing a yarn consisting of numerous filaments, using:

5 (a) a spinneret having numerous spinning holes to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from  
10 said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

15 (e) a winding means for winding the numerous filaments coming from said filament take-up means,  
characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering  
20 the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous  
25 filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of

said spinning tube, and

(g) the velocity of the gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube is not less than 60% of a take-up speed of the numerous filaments taken up by said filament take-up means.

2. A method for producing a yarn, according to claim 1, wherein said numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of said rectangle agrees with the direction of said straight line; and the following relation is satisfied

$$d \times 3 \leq E_x \leq d \times 20$$

where  $E_x$  is the length of the short sides of said rectangle, and  $d$  is the diameter of said spinning holes.

15 3. A method for producing a yarn, according to claim 2, wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

4. A method for producing a yarn, according to claim 1, wherein the following relation is satisfied:

20  $L_a \leq L_g/2$

where  $L_g$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and  $L_a$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

5. A method for producing a yarn, according to claim 4, wherein the velocity of the gas stream flowing downward together with said numerous filaments in the filament passage of said spinning tube is higher than the running speed of said numerous filaments in the range of the distance  $L_g$  between said spinneret and the position at which the running speed of said numerous filaments reaches the take-up speed of the numerous filaments taken up by said filament take-up means.

6. A method for producing a yarn, according to claim 1, wherein a gas suction and discharge means for sucking and discharging gas existing around the numerous filaments running from said spinning holes toward said filament passage is installed between said spinneret and said spinning tube, to ensure that the gas existing around said numerous filaments can be sucked and discharged.

7. A method for producing a yarn, according to claim 6, wherein the numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of said rectangle agrees with the direction of said straight line; and the following relation is satisfied

$$Ex \leq 10 \text{ mm}$$

where  $Ex$  is the length of the short sides of said rectangle.

8. A method for producing a yarn consisting of numerous filaments, using:

(a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

5 (c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

(e) a winding means for winding the numerous filaments coming  
10 from said filament take-up means,  
characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous  
15 filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward  
20 together with the numerous filaments in the filament passage of said spinning tube, and

(g) the following relation is satisfied:

$$L_a \leq L_g/2$$

where  $L_g$  is the distance between said spinneret and the position  
25 at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments

taken up by said filament take-up means, and  $L_a$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

9. A method for producing a yarn, according to claim 8, wherein  
5 the velocity of the gas stream flowing downward together with said numerous filaments in said filament passage is higher than the running speed of said numerous filaments.

10. A method for producing a yarn consisting of numerous filaments, using:

10 (a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from  
15 said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

20 (e) a winding means for winding the numerous filaments coming from said filament take-up means, characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering  
25 the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to

ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward  
5 together with the numerous filaments in the filament passage of said spinning tube, and

(g) a gas suction device is provided between said spinneret and said spinning tube, to suck the gas existing around said numerous filaments and to discharge the gas outside.

10 11. A method for producing a yarn, according to claim 10, wherein the width of said filament passage in the direction perpendicular to the direction in which said numerous filaments are disposed side by side is 10 mm or less.

12. A method for producing a yarn, according to claim 10, wherein  
15 the suction of the gas existing around said numerous filaments is carried out on both sides of the disposal of said numerous filaments.

13. A method for producing a yarn, according to claim 10, wherein said numerous spinning holes are arranged in straight lines; and  
20 the number of the straight lines is 3 or less.

14. A method for producing a yarn, according to claim 10, wherein outside air suction spaces are formed between said gas suction device and said spinning tube, to ensure that the sucked outside air flows into said filament passage.

25 15. An apparatus for producing a yarn consisting of numerous filaments, having:

(a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

(e) a winding means for winding the numerous filaments coming from said filament take-up means, characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

(g) a means is provided for adjusting the injection conditions of the gas injected from said gas injection holes or adjusting the take-up speed of the numerous filaments taken up

by said filament take-up means, to ensure that the velocity of the gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube is not less than 60% of the take-up speed of the numerous filaments taken up by said filament take-up means.

16. An apparatus for producing a yarn, according to claim 15, wherein said numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of said rectangle agrees with the direction of said straight line; and the following relation is satisfied:

$$d \times 3 \leq E_x \leq d \times 20$$

where  $E_x$  is the length of the short sides of said rectangle, and  $d$  is the diameter of said spinning holes.

17. An apparatus for producing a yarn, according to claim 16, wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

18. An apparatus for producing a yarn, according to claim 15, wherein the following relation is satisfied:

$$L_a \leq L_g/2$$

where  $L_g$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and  $L_a$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.



19. An apparatus for producing a yarn, according to claim 18, wherein the velocity of the gas stream flowing downward together with said numerous filaments in the filament passage of said spinning tube is higher than the running speed of said numerous  
5 filaments, in the range of the distance  $L_g$  between said spinneret and the position at which the running speed of the numerous filaments reaches the take-up speed of the numerous filaments taken up by said filament take-up means.

20. An apparatus for producing a yarn, according to claim 15,  
10 wherein a gas suction and discharge means for sucking and discharging the gas existing around the numerous filaments running from said spinning holes toward said filament passage is installed between said spinneret and said spinning tube, to ensure that the gas existing around said numerous filaments can be sucked and  
15 discharged.

21. An apparatus for producing a yarn, according to claim 20, wherein the numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of  
20 said rectangle agrees with the direction of said straight line; and the following relation is satisfied:

$$Ex \leq 10 \text{ mm}$$

where  $Ex$  is the length of the short sides of said rectangle.

22. An apparatus for producing a yarn consisting of numerous  
25 filaments, having:

(a) a spinneret having numerous spinning holes formed to

discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

(e) a winding means for winding the numerous filaments coming from said filament take-up means, characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

(g) the following relation is satisfied:

$$L_a \leq L_g/2$$

where  $L_g$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their

flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and  $L_a$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

5 23. An apparatus for producing a yarn, according to claim 22, wherein the velocity of the gas stream flowing downward together with said numerous filaments in said filament passage is higher than the running speed of said numerous filaments.

24. An apparatus for producing a yarn consisting of numerous  
10 filaments, having:

(a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run  
15 downward from said spinneret, and installed below and spaced from said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous  
20 filaments coming from said oiling means, and

(e) a winding means for winding the numerous filaments coming from said filament take-up means,  
characterized in that

(f) gas injection holes are provided, which inject gas  
25 obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous

filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous  
5 filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

(g) a gas suction device is installed between said spinneret and said spinning tube, to suck the gas existing around said numerous  
10 filaments and to discharge the gas outside.

25. An apparatus for producing a yarn, according to claim 24, wherein the width of said filament passage in the direction perpendicular to the direction in which said numerous filaments are disposed side by side is 10 mm or less.

15 26. An apparatus for producing a yarn, according to claim 24, wherein the suction of the gas existing around said numerous filaments is carried out on both sides of the disposal of said numerous filaments.

27. An apparatus for producing a yarn, according to claim 24,  
20 wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

28. An apparatus for producing a yarn, according to claim 24, wherein outside air suction spaces are formed between said gas suction device and said spinning tube, to ensure that the sucked  
25 outside air flows into said filament passage.